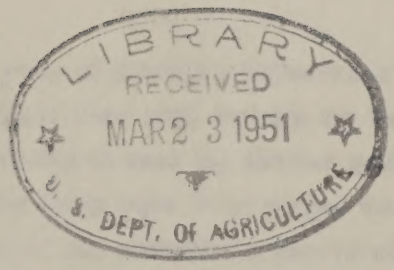
STATUS REPORT
ON
PIN INSULATOR FAILURES



November 1950

U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION
TECHNICAL STANDARDS DIVISION

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A. GENERAL

Pin insulator failures due to puncturing have presented a serious problem to distribution cooperatives, particularly in the southern and central portions of the United States. This report is being issued to describe the present status of an investigation of the problem.

The puncturing of insulators is normally through the top groove or side groove, where the distance to the insulator pin from conductor or tie wire is the smallest. Such a failure often can not be seen from the ground or even from the pole top before the tie is removed, and it may cause a line outage only when moisture is present, at night or during rainy weather. When an epidemic of such failures occurs, the total cost in service interruptions, maintenance labor, and general ill will is hard to estimate.

B. CAUSES OF FAILURES

Insulators puncture under conditions where the half inch or so of porcelain between conductor and pin provides less insulation than the longer arc-over path through air or over the insulator surface. Lightning surges have a tendency to seek the shorter path through the porcelain, and this tendency increases for the steep wave front surges that cause extremely rapid voltage rise. Any pin type insulator can probably be punctured if the wave front is steep enough. However, it is felt that insulators can be produced that will flash over before puncturing under practically all of the conditions that arise in service, so that puncturing of insulators need not be a problem.

Insulators can be damaged by dropping or other rough handling, so that cracks will later permit electrical break-down. Pin insulators are probably less susceptable to such damage than suspension types. Screwing down a pin insulator too tightly on the threads also may cause cracking of the porcelain that will result in electrical break-down. Such circumstances, plus occasional manufacturing defects, may result in scattered failures during the first few years of operation, but should not cause any serious difficulties.

C. CORRECTIVE ACTION

The most effective remedies for insulator puncture problems must finally be applied by manufacturers, since puncture resistance is largely determined by the design of the insulators and quality control during manufacturer. We feel that the tests prescribed in the NEMA High Voltage Insulator Standards are not enough to assure the high standards of puncture resistance required for rural service. It is known that some manufacturers apply additional tests to control the quality of the finished product. The cost of each insulator failure on a rural system is so great that even a low percentage of failures, acceptable for almost any other equipment, is not acceptable in the case of pin insulators.

The investigation of pin insulator failures by REA is being directed mainly toward setting up standards for pin insulators that will provide adequate puncture resistance. Toward that objective, information is being secured as follows:

1. From insulator manufacturers, data are being obtained on the tests and other quality control measures being applied.
2. From REA borrowers, all available information has been recorded from reports of insulator failures to compare the performance of the various kinds of insulators in use. The following data are being recorded whenever available:
    a) Manufacturer of insulator and catalog number.
    b) Number of failures noted.
    c) Estimated number of this make insulator in service.
    d) Approximate date insulators were purchased and installed.

If data from REA borrowers and other investigations indicate that any particular kinds of insulators are not satisfactory, recommendations will be made to remove such insulators from the List of Materials Acceptable for Use on REA-financed Systems. However, an additional objective is to learn which tests are most effective in controlling the quality of pin insulators so that such tests can be incorporated into REA specfications for all insulators. The same tests will be applied as necessary in checking insulators when tests are made to determine whether they are satisfactory for REA use.

Reports of unsatisfactory insulator performance are directed to the attention of the manufacturers of the insulators with the object of determining the reasons for poor performance of the insulators.

Manufacturers have determined in some cases that defective insulators were sold and installed, and in such cases have generally furnished new insulators and made additional adjustments to cover the cost of replacement. At least one manufacturer has found that in 1948 and 1949 some lots of insulators were sold that were not sufficiently fired and that puncture failures of the insulators were excessive for that reason. This manufacturer added production line tests to prevent any more of such insulators for leaving the factory, and reports that all insulators shipped since September 1, 1949 have passed the more rigid tests.

Borrowers who experience trouble from excessive puncturing of insulators may save time by promptly getting in touch with the supplier or manufacturer in addition to reporting the difficulty to the Regional Engineer. Information sent to the Regional Engineer should include the manufacturer and catalog number of the insulator, the number of that make insulators in service, and the approximate date the insulators were purchased and installed.

The names of a number of manufacturers are notably absent from the complaints that have been received regarding pin insulator performance. At present we are not sure whether this is due to better quality of some makes of insulators, smaller numbers of those makes in service in lightning areas, or failure of some manufacturers to mark insulators so that they can be identified. Information is needed on the estimated numbers of other kinds of insulators that perform satisfactorily in areas where puncturing is frequent. It is requested that borrowers reporting pin insulator failures report also the approximate number, make and age of other insulators that are giving good service.

Location of defective insulators can be made easier by use of radio detection methods, since a punctured insulator is "noisy" to radio receivers when it is not leaking enough to operate a sectionalizing device or be evident otherwise. Noise from a leaky insulator will not oridinarily be noticed on the FM receivers used on line trucks for two-way communication.

A useful accessory for locating defective insulators is a small neon lamp taped to the end of a hot stick, A small NE 30 or 32 lamp with the base and resistor removed may be used. The short wires coming out of the glass bulb should be extended in a manner similar to a rod dipole antenna used in television reception. Each wire should be about 3/4" long. This lamp should glow within three to four feet of a defective insulator or bushing depending upon the severity of the interference signal, while a good insulator will show no indication at six to eight inches. These differences will, of course, vary

with the line voltage as well as with the individual lamp used.

A discussion of radio detection methods is given in the bulletin "Location of Radio Interference on Rural Power Systems," published in September, 1950. The preceeding paragraph was taken from that bulletin, which is to be distributed as part of an Engineering Memorandum. Copies may be obtained prior to the normal distribution by writing to the Regional Engineer.